

Three-Dimensional Art Drawing Techniques in the Dental Anatomy Curriculum

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Running title: Students' perceptions with three-dimensional art drawing techniques for dental anatomy

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Problem:

As da Vinci's work demonstrated more than 700 years ago, arts and sciences are overlapping disciplines that positively impact each other.¹ Arts incorporation has been reported to enhance and foster creativity in sciences education.^{2,3} The dental anatomy course at the University of Michigan School of Dentistry utilizes waxing-up exercises and a very efficient and technological approach to teach dental anatomy using augmented (AR) in the dental anatomy course and assessments.^{4,5} The use of AR technology has reduced faculty time and facilitated the assessment logistic as the physical presence of human extracted teeth is not required.^{4,5} Additionally, a three-dimensional visual guide application (3D App) has been created and added to the dental anatomy course to enhance students learning and knowledge retaining. The 3D App has been shown to increase performance in dental students while facilitating learning for the students who mostly struggle visualizing the

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anatomical landmarks of human teeth. Although the 3D App has been very successful, this technology does not promote the benefits of cooperative learning among students.⁶

Additionally, the 3D app does not allow students to improve their tooth drawing skills nor to develop their artistic skills, and creativity.

Solution:

To complement the use of AR and 3D App technologies in our dental anatomy teaching approach, we tested the feasibility of incorporating arts in the dental anatomy curriculum as tool to promote peer collaboration and to improve students' drawing skills and creativity. To accomplish that, we invited an artist and art faculty to run a three-dimensional artistic drawing workshop to dental students in the regular teaching settings, the simulation laboratory. The drawing session was run as the last session of the course and as an elective activity for the dental students. The art drawing workshop had the duration of one hour and it was held only once during the course. The art drawing workshop was designed to expose students to three-dimensional artistic drawing techniques that aimed to improve the students' drawing skills with the goal to allow the students to draw teeth three-dimensionally. The techniques, learning objectives and drawing illustrations can be depicted at Table 1. The benefits of each technique applied in the workshop and the observed challenges are described at Table 2.

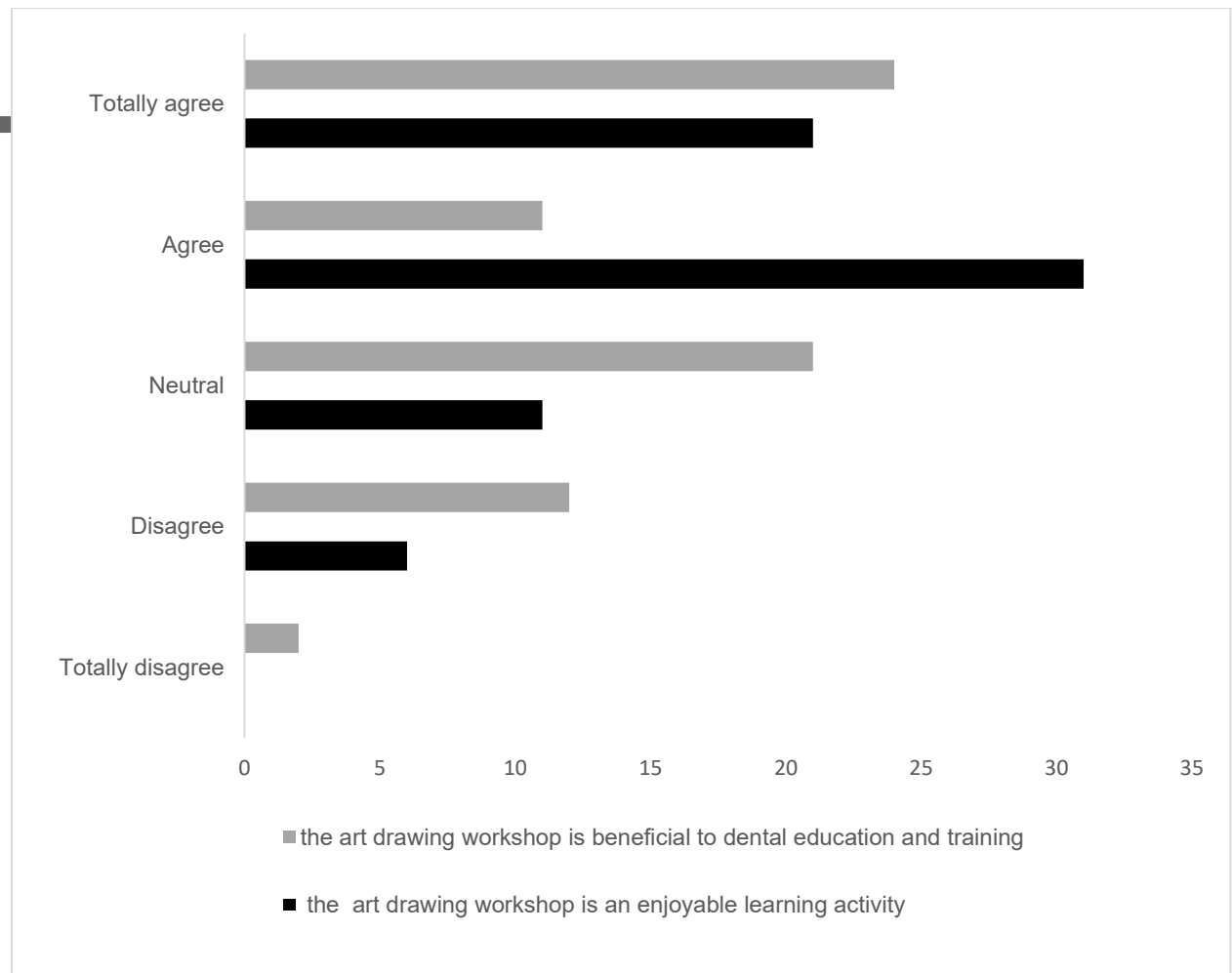
Results:

This study was considered exempt by the Institution Review Board (HUM00225138). A total of 109 students were invited to participate in the art drawing workshop and to answer a Qualtrics anonymous short 2-question survey and an open-ended question to obtain the students' suggestions for future art workshop sessions. The 2-question survey was designed to assess the students' perceived experience with the art drawing workshop. All students participated in this elective workshop and a total of 70 students fully answered the survey. A total of 76% (N=53) of the respondents reported they enjoyed the art drawing workshop, and 50% (N=35) of the respondents perceived the practiced art drawing techniques as beneficial to their dental training and education. When asked about feedback to improve the workshop, most of the students reported to "love" the workshop and suggested including additional 3D techniques to facilitate the drawing of different tooth shapes. Although most students found the art drawing workshop enjoyable, only half of the students perceived its value for the

dental education and/or training. It is possible that some of the dental students did not see the value of the art workshop for their dental education because they were not familiar with the concept of integrating arts to sciences education and its potential benefits. The summary of the students' perceived experiences with art drawing workshop can be seen on Figure 1. Nevertheless, we concluded that the incorporation of art drawing techniques in dental anatomy curriculum is feasible and very well received by dental students. Based on the students' positive feedback (Figure 1) and faculty perceived challenges (Table 2), we will further improve and expand the art workshop. Importantly, to increase the students' knowledge of art-sciences integration and peer collaboration, we plan to implement in the art workshop group activities to use drawing as a communication and problem-solving tool.

Figure

Figure 1: Students' perceived experiences with the art drawing workshop



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Tables:

Table 1: Art drawing workshop

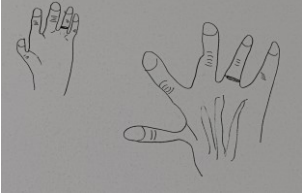
Workshop Activity (time)	Learning Objectives	Illustration
<u>Techniques</u> Warm-up (5 minutes) <u>Freehand</u> • ellipses • spirals • coils	1. To prepare muscles, ligaments for the hand activities 2. To connect the mind, to the eyes and the hands	
Typodont Drawing (20 minutes) <u>Observation drawing</u>	1. To visualize and analyze 3D forms through close examination. 2.To mentally question while drawing •How is it made? •What is its most simplified geometric (cylinder, cone, sphere, cube) form? 3. To translate (even roughly) what the students see onto paper as a result of letting their eyes lead their hands	
Hand drawing (20 minutes) <u>Blind contour</u>	1. To tune into the connection between the eye and the hand. 2. To hone observation skills by focusing on what students see rather than what they think they see.	
Closing remarks and survey (10 minutes)	1. To review the session activities 2. To review, discuss and comment each other's drawings 3. To remind students on how and when the 3D techniques can be useful along the dental program	

Table 2: Art drawing workshop: Techniques, benefits and challenges

Techniques	Benefits	Challenges
Freehand	1. To bring focus and awareness to the body posture, stance and coordination. 2. To encourage best practices for how to hold the pencil, arm and body while drawing.	• Adding more art faculty to help students as they draw
Observation drawing	1.To improve eye/hand coordination. 2.To deepen the physical understanding of the form (in this case teeth). 3.To offer and interdisciplinary experience (art and science) 4.To integrate creativity to enhance understanding.	• Having a larger typodont or a common model for all students to draw the same object • Adding more art instructors to facilitate the drawings
Blind contour	1.To explore the feeling of letting the eyes take over. 2.To create an opportunity for amusement and humor amongst the group 3.To foster peer collaboration	• Adding extra time to the session for students to explore other blind contour experiences and drawings